LOWER COLORADO RIVER AUTHORITY SHARED RADIO SYSTEM

ABSTRACT

The Lower Colorado River Authority was created in 1934 to manage the unpredictable Colorado River, provide low-cost electricity throughout the region and enable the sustainable development of central Texas without jeopardizing its unique natural resources. As the region's growth continues its rapid pace, technology offers many opportunities to expand the economic base of many small communities, limit the impact of growth on the environment and improve public safety. LCRA's Community Link program was designed to improve the availability of mobile voice and data transmission technology to rural central Texas communities. As part of the Community Link program, LCRA completed an upgrade project to replace its aging mobile radio infrastructure. In doing so, LCRA not only met its own business needs but allows customers and communities to gain access to advanced technology through the use of its telecommunication facilities.

LCRA's Regional Radio System

Imagine this: *A nervous father reports a missing child to a local 911 telephone dispatch station. A broadcast is sent over the public safety wireless communications network describing the child. The broadcast is immediately received by all local, state, and federal public safety workers in the area. A local policeman sends out a radio message to all the public safety workers warning of dangerous flooding from heavy rains in the area where the child was last seen. A park ranger responds to the flood area and locates the little girl trapped on an embankment between two washed out ravines. The ranger immediately notifies the fire and rescue services, which respond in minutes. The child is returned home safely. The little girl was rescued because all relevant public safety officials were able to communicate over a common, secure, communications network.*[1]

The September 1993 National Performance Review report recognized the need for improving public safety communications capabilities. The report highlighted the need to address key challenges, such as competition for limited radio spectrum, limited public safety budgets, and keeping pace with advances in technology. To be effective before, during, and after their response, public safety officials, throughout all levels of

[1] National Performance Review, Al Gore, Vice President of the United States, A06: Establish The Intergovernmental Wireless Public Safety Network

government, must be able to communicate with each other.

The seeds having been planted, LCRA revised its project goal of replacing its aging radio system for internal use to a shared-use concept to benefit the entire region. What began more than a decade ago as a first-of-its-kind project continues to blossom into the reality that was originally envisioned. The completion of this project could not have been more timely in light of the current homeland security issues and interoperability initiatives. LCRA's efforts in developing a seamless, trunked radio system within Texas as part of its overall telecommunications strategy is recognized by a number of state and local entities as a model public safety system.

Goal: LCRA, while meeting its own communications requirements, will help provide access to competitively priced telecommunications services by the rural communities within its service area.

The following narrative does not delve into the technical project specifics of building this radio system but rather the thoughts, strategies and collaberation that is shaping its success.

Executive Summary

Changes brought about by the Telecommunications Act of 1996 offered new opportunities for both public and private organizations to participate in everything from cable television

to telephone service. While LCRA will not be in the telephone or cable business, unique opportunities presented themselves with respect to radio communications with our wholesale electric customers and other public, nonprofit and governmental agencies. These opportunities contribute to four important goals of LCRA: providing for the public safety, supporting community development, providing reliable services and keeping internal costs low. The overriding objective for LCRA with this radio system is to establish partnerships with entities that provide solid solutions for each party's vision and objectives. Partnerships that are attractive to LCRA include municipal utilities and electric cooperatives; state agencies such as the Texas Parks and Wildlife Department and the Texas Department of Transportation; school districts; counties (including sheriff's offices, volunteer fire departments, and emergency medical services); and municipal law enforcement agencies. There is also an opportunity for LCRA to form alliances with other large utilities and private service providers. These entities have radio and communications systems similar to the one that LCRA has installed.

LCRA's role also includes coordination of community planning for disasters and other naturally occurring events. LCRA must be able to communicate reliably with law enforcement and public safety officials, especially during floods or during a severe power outage. Several key strategies were formed to fulfill this role: customer input, affordability, environmental protection and operational effectiveness.

By offering this first-of-its-kind regional radio system, LCRA will continue its role as a leader in Central Texas. From the days when the Colorado River regularly flooded and

Texas was without a reasonably priced source of electricity, LCRA has been there to meet the public's needs. Today, technology is essential to community development and prosperity. It is readily available in metropolitan areas but not in rural Texas. That is changing, in part, due to the efforts of LCRA. This regional radio system now serves 19 public safety entities, three transportation companies, six wholesale electric customers, one school district and three other agencies.

Introduction

LCRA was created in 1934 by the Texas Legislature as a water conservation district and hydroelectric generation power provider headquartered in Austin, Texas. Today, LCRA has a generating capacity of more than 2,500 megawatts and a transmission system territory that stretches to 58 counties. The generation and transmission systems serve more than 1 million Central Texans with electricity through 42 wholesale customers (nine electric cooperatives and 33 municipalities). More than 3,300 miles of electric transmission lines and supporting telecommunications infrastructure are in place to support these customers. LCRA also provides water/wastewater services and maintains water quality in the lower Colorado River basin, an area several hundred miles long that stretches from San Saba County to Matagorda Bay. Together, the water and electric service areas cover more than 30,000 square miles.

LCRA has no taxing authority. All funds come either from ratepayers or from state and federal grants. It is a regional provider of services, a facilitator for local governments and is charged with meeting public safety needs as it relates to both water and electric service.

The Electric Reliability Council of Texas (ERCOT) also counts on LCRA and its radio system to play a key role in the "Blackstart" operations if there should be a statewide failure of the electric grid.

As the case is with most utilities, LCRA's prior radio system was pieced together over the years as new technologies and frequency bands were made available. In the 1940s through the 1960s it started out as a lowband system operating in the 30 to 50 MHz range. The 1970s saw the addition of high band and the 150 MHz public safety frequency. Finally, in the 1980s, the 450 MHz UHF band was added. These disparate systems caused much confusion among the different work groups which led to either inefficient or nonexistent communications as well as fostering an operational and maintenance nightmare.

In the early 1990s the airways in these conventional bands became crowded, the Federal Communications Commission (FCC) spoke of impending radio spectrum reallocation and LCRA's radio equipment was becoming obsolete. These factors caused LCRA to reassess its future communications requirements. At the same time, LCRA realized that public safety, counties and cities were dealing with many of the same issues of obsolete equipment, interference, capacity and coverage.

LCRA's role in all of this became clear: provide a regional, public safety dispatch radio network to support its mission-critical operations and public service obligations. LCRA's emergency, operational, community development and customer relations requirements

make the radio system essential to LCRA's success. Developing partnerships linked with this system would allow rural citizens to overcome the isolated nature of their areas and enhance community development due to better coordination among public service organizations such as police, medical, fire and emergency management.

The Plan

Participation is a key theme for LCRA's plan, for it designates that LCRA will not solely invest in this effort but will engage in it through sharing agreements with its customers and other non-profit entities. Specifically, LCRA wants this project to:

- Demonstrate that "government at its best" as represented by LCRA can act as a catalyst for cooperation and serve as a model for other governmental entities.
- Help state entities such as the Department of Public Safety, Texas Department of Transportation and the University of Texas System obtain low-cost access to a land mobile radio system.
- Provide public safety entities the opportunity to have advanced radio communications, including mobile data, they could not otherwise afford. It also creates the potential for cost savings by supporting the establishment of regional 911 dispatch centers operated by county coalitions.
- Improve the ability of state and local agencies to coordinate their work under disaster recovery conditions.

Key strategies for accomplishing LCRA's goals are:

Corporate Strategies

- **Customer Input:** In planning for new telecommunications systems, LCRA will seek input from wholesale customers and communities to help identify their business needs and requirements.

- **Cost and Pricing:** LCRA can improve and enhance its radio technology at the lowest practical cost. In planning, LCRA will evaluate various alternatives to identify the most cost-effective solutions. ***LCRA's strategy to partner with public entities in the planning, construction and use of the network allows LCRA an opportunity to provide low cost mobile radio communications to LCRA business units, nonprofit organizations, communities and customers at cost-based prices.***

LCRA will not offer telecommunications services to the general public or private businesses as a common carrier.

- **Environmental Protection:** LCRA has statutory responsibility for conserving natural resources. By utilizing existing rights of way and existing towers the environmental impact of new facilities will be minimized. If a new tower does need to be built, an environmental review will be performed before the start of any construction to limit the impact to the surrounding environment. In addition, any available space on the tower will be leased to other wireless providers to further limit the impact of building more towers.

Operational Strategies

- **Frequency Band Selection:** Use the 900 MHz band for both channel availability and compliance with future FCC requirements for 12.5 KHz channels and further migration to 6.25 KHz channel spacing. The Austin metro area and areas near San Antonio and Houston do not have the required number of 800 MHz frequencies available.
- **Secure adequate radio licenses:** File applications and obtain enough channels to support internal as well as expected external users. File and obtain waivers to allow public safety entities access to the system.
- **Secure five-year slow growth construction period:** Building 30 sites, as proposed in the first phase of the project, will require more than one year as allowed through the standard licensing process. Also, by requesting the additional time to construct, more opportunity for loading the system will be realized.
- **Regional coordination:** Emergency coordination and planning is being revisited by LCRA with an initial focus on flood response.
- **State agencies:** Opportunities will be pursued with the Texas Department of Public Safety, Texas Department of Transportation and Texas Parks and Wildlife Department.
- **Mobile Data:** Mobile data applications will be made more affordable to rural communities for public safety, public transportation and other purposes.
- **Coverage:** Determine number and placement of sites and channels to cover 90 percent of the service area 90 percent of the time.

- **Identify growth opportunities within desirable areas:** Additional sites will be constructed and capacity will be added to existing sites based upon growth either from LCRA users or third-party users.

The Project

In 1995 LCRA went through a formal request for proposal and selection process. Ericsson's proposal was selected as most closely meeting LCRA's requirements based on a technology evaluation, alliance opportunities and financial considerations. It would provide trunking technology, regional coverage, interagency coordination and telephone interconnect for both voice and data communications. The sites would have emergency power backup and backhaul would primarily be provided over LCRA's digital microwave system.

Construction of the first phase of the radio system began in June 1996 and was completed in August 1997. The first phase consisted of 30 sites which covered the heavily used territory for generation, transmission and water services. During construction, loading of internal users began on a limited basis. The majority of the electric and water operations personnel, however, required wide area coverage and, therefore, conversion of these areas to the new system was delayed until September 1997. Some external users had urgent needs for improved service and they were brought on to the system prior to the completion

of the first 30 sites. The 31st site was not constructed until 1998. The City of San Marcos, just south of Austin, indicated an interest in using LCRA's system for all city departments. Following approval of an interlocal agreement by the San Marcos City Council to participate in the system, the 31st site was installed in San Marcos in July 1998. With the completion of the 31 sites throughout LCRA service area, the remainder of LCRA's internal users' needs were satisfied. In addition, an operations center open round the clock was added to house the central switching and monitoring equipment and to respond to customers' needs.

More sites have been added each year to keep pace with the voice and data requirements of both internal business units and external entities. To date, close to 300 radio channels are operated from 45 permanent sites with two more sites in the planning stages. Two mobile sites, which respond to emergency situations, are also available. The radio system has proven to be very robust. In the past year the system logged 58 million push-to-talks with very little down time.

Customer and Community Participation

LCRA's radio network supports the goal of the Texas Legislature and the federal government to establish regional emergency communications systems. The Interlocal Act provides authority for political subdivisions to contract with other political subdivisions to perform a "governmental function in which the contracting parties are mutually interested."

Candidates for using LCRA's mobile radio services include state agencies such as the Texas Department of Transportation and Department of Public Safety, LCRA wholesale electric customers, county governments, municipal governments, school districts, county extension agents, sheriff's departments, emergency medical services, fire departments, volunteer firemen and other public entities. Each community and various state and local governmental agencies are potential subscribers to LCRA's mobile radio system.

The following is a list of current subscribers:

- Bluebonnet Electric Cooperative
- City of Boerne
- Boerne Electric Utility
- Capital Metro Transit Authority
- Capital Area Rural Transit System
- Central Texas Medical Center
- Colorado Valley Transit
- City of Elgin
- City of Fair Oaks Ranch
- Fayette County
- Fayette Electric Cooperative
- City of Flatonia
- Flatonia Electric Utility

- City of Fredricksburg
- Gillespie County
- Hays County
- Kyle Emergency Services District
- Kendall County
- City of Kerrville
- Kimble County
- City of LaGrange
- City of New Braunfels
- Round Rock ISD
- City of San Marcos
- San Marcos Electric Utility
- San Bernard Electric Cooperative
- City of Schulenburg
- Hays County
- South Hays County
- Texas State University – San Marcos
- Texas Dept of Transportation
- University of Texas, Houston

Community Benefits

From the time this radio system went on the air seven years ago there have been many examples of extraordinary public service and community benefits. Some of these examples happened in communities that subscribe to the system and other examples are in areas where LCRA loaned radios to a community to get through a particular disaster or event. In addition, LCRA also provides free loaner radios to many annual charity events used for coordination and security purposes. The following list contains a few of those examples:

- City of San Marcos

  In September 1998, the City of San Marcos equipped all city departments with 900 MHz radios and began using LCRA's mobile radio system for their critical communications. Police, fire, electric utility, parks, and public works transitioned from their old radio systems which were not meeting their needs to a system capable of supporting multiple simultaneous conversations and mobile data. Six weeks later, a historic flood occurred on the Blanco and San Marcos rivers that tested the response of the city employees and their new radio system. Due to the superior performance of both the city employees and the radio system, many citizens were rescued and in the city limits there were no lives lost. Police Captain Mark Minnick attributed this success to their ability to communicate between city departments during the event. From the San Marcos Emergency Operations Center (EOC), disaster coordination management could monitor all radio traffic to verify progress as it unfolded and dispatch city assets where needed. The EOC had the capability of talking to every department and patch various talk groups together. As one police official stated "It was a godsend. We would have had to coordinate through the various departments'

chain of command using a limited number of conventional frequencies dedicated to the various departments and would have had to resort to cell phones and other means of communications. From the EOC we could coordinate directly with the city crews and rescue personnel." During the peak 24-hour period of the flood there was nearly 500,000 PTTs on the primary site serving the City of San Marcos with less than 2 percent calls queued. During this event an electrical substation serving the city and LCRA was flooded. Even though the LCRA T-1 digital communications circuit that connects the San Marcos Police Department dispatch and EOC to the LCRA system was affected the redundant backup systems kept the EOC on the air.

- **CARTS**

  The Capital Area Rural Transportation System (CARTS) provides rural bus service in nine counties of central Texas. Each bus is equipped with a mobile radio that uses LCRA's radio system and maintains direct contact with the CARTS dispatchers. The use of the radio system enables each bus driver to be dispatched continuously and report on progress throughout the day. This provides added safety and security for both driver and passengers. In addition, significant change has occurred in the operation at CARTS. The three CARTS regions had been dispatched from three separate locations, Austin, Smithville and San Marcos. Due to the coverage provided by LCRA's wide area mobile radio system, the entire operation of more than 80 buses are dispatched from the Austin office. The initiation of centralized dispatch offers efficiencies that could not have been realized using any other communications system. Enhancements have included an update to their mobile data software to allow better

route scheduling along with Automatic Vehicle Locating software to keep track of the vehicles.

- City of Cuero

  Rains of up to 16 inches on Oct. 17 and 18, 1998 produced record floodwaters downstream of Austin, exceeding previous record levels in some areas that were set by the Christmas Flood of 1991. Flooding was even worse in the adjacent Guadalupe River basin. LCRA spent the following months assisting Cuero, a wholesale electric customer located on the Guadalupe River, in cleaning up flood debris and repairing electrical transmission and distribution equipment. The radio system played a large part in the coordination of this effort.

- Hays County

  During the summer of 2001, residents of a Hays County subdivision just fives miles from San Marcos were forced to evacuate as a nearby wildfire threatened their homes. Firefighters and law enforcement officers from at least 15 agencies battled the flames at locations miles from each other — a difficult process until the LCRA brought in 30 of its mobile radios to assist their coordination efforts. After a four-day showdown with firefighters, the wildfire ended its rampage but not until it had consumed more than 1,100 acres and several uninhabited structures making it the largest reported fire in Texas that year.

While the fire damage was substantial, San Marcos Fire Marshal Kenneth Bell believes it could have been much worse without LCRA's radios. Because the City of San Marcos had been an LCRA customer for three years, Bell knew the radios' capabilities and who to call for assistance. "Before the LCRA brought in their radios we were trying to work off of five different channels at the same time, which made fighting the fire nearly impossible," said Bell, who also served as the logistics coordinator during the incident. "At one point, I was juggling four radios in my hands. By the time we would finally get information about our strategy to the last group, the plans had changed." When Bell called in his emergency request for radios at 7 p.m., he not only received 30 LCRA radios on the double, he also got the help of two LCRA employees who served as a mobile repair shop until about 4 a.m. Another two-man LCRA Telecommunications crew assisted firefighters the next day. "When we hear that somebody needs help, we come running," said LCRA's Ray Goehring, a radio shop area supervisor. "We fixed antennas, reprogrammed radios, recharged batteries and did whatever we could to help. We also brought spare batteries because the firefighters' hand-held radios were starting to go out."

To Bell and the other firefighters, most of whom were volunteers, the level of customer service provided by the LCRA truly was life saving. "The fire almost over-ran a few guys but fortunately we were notified and able to send a helicopter to assist them," Bell said. "If that had happened prior to using LCRA radios we would never have even known their lives were in danger and we never would have known that we were possibly putting people in harm's way."

- City of Smithville

  In May 1999, the city lost power on graduation night. The city police were running on back-up power which was also beginning to fail. LCRA received word of the problem and rushed radios to them. The police department was able to continue their coordination efforts and the events of the evening went on as scheduled.

- City of Stonewall

  In October 2001, a tornado touched down in this tiny community located about 70 miles west of Austin. LCRA responded with its mobile Emergency Communications Unit to provide a temporary command center for interoperability between the Gillespie County Sheriff's Department and other rescue volunteers.

- City of New Braunfels

  On July 4, 2002, a powerful storm hit the New Braunfels area causing massive flooding along the Guadalupe River which runs through the city. LCRA delivered 50 radios to the New Braunfels Police Department to coordinate activities between them, Comal County Sheriff's Department and other agencies involved in the rescue and evacuation operations.

- Thanksgiving Day Flood

  In a two-week period surrounding the 2004 Thanksgiving Day holiday, two storms hit the Central Texas area causing massive flooding throughout LCRA's territory. The

first storm hit west of Austin causing the lakes to rise above full. As LCRA began floodgate operations on the highland lake dams the next storm hit east of Austin, below the dams so that the floodgate operations had to be postponed. Flooding occurred both upstream and downstream of the dams causing widespread damage. Once again LCRA's radios were used as a truly regional radio system to coordinate emergency relief efforts along the Colorado River.

Radios were used by Hays Independent School District to coordinate evacuation communications between the administration, bus drivers and parents. The Emergency Communications Unit was taken to Wharton to set up a mobile command post where ultimately 150 homes and businesses were flooded. Up to 16 inches of rain fell per day in some areas during this two week period and 10 to 12 inches per day was not uncommon.

An amazing number of volunteers came together to work through this natural disaster. After it was over, not one life was lost. This is a true testament to the strong wills and perseverance of the volunteers and public safety personnel.

- Multi-Agency Shared Data Service

In January 2001, LCRA helped the City of Boerne acquire and implement an Aether Systems data application to give them the ability to verify license plates, check wants and warrants and generate reports while still in the field, utilizing their existing LCRA radios. Other LCRA public safety radio users are able to share in this data network,

with permission from the City of Boerne, thereby saving all of the entities time and resources by not having to create duplicate networks. Current participants include the Fredricksburg, Kerrville and LaGrange police departments, Kimble County, Texas Department of Public Safety and Gillespie County.

Annual Community Events Using LCRA Free Loaner Radios

- Fayette County Fair
- Liberty Hill Charity Bike Ride
- World Water Quality Monitoring Event
- Flatonia Police Department Chilispeil
- Hill Country AIDS Ride
- Bluebonnet Festival
- Relay For Life
- LaGrange Boy Scouts
- Columbus Lion's Club Annual Bike Ride
- San Marcos Special Olympics
- Lonestar Boy Scout Camp
- Hill Country Advocacy Bike-A-Thon
- Armadillo Hill Country Classic
- Shoes For Austin
- Schulenburg Festival
- Liberty Hill Lions Club

- San Marcos Sights and Sounds
- Boy Scouts River Training Program

Conclusion

LCRA, through the implementation of the mobile radio system, is contributing significantly to the improvement of public safety and quality of life within Central Texas. In fact, due to the regional nature of this radio system, it is a key component to the State of Texas Homeland Security considerations and efforts in which LCRA is an ongoing participant.

Whether the radios are used to recover from a natural disaster, day-to-day operations or a community event, the use of a regional system by a combination of police, fire, emergency medical services, utility, parks, rural transportation and highway maintenance personnel make this system a model of efficiency and flexibility. Continued expansion of the user community is expected as the existing radio users demonstrate the benefits of an innovative shared system concept.